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APPLICATION NO.	FILING DATE	FIRST NAMED INVENTOR	ATTORNEY DOCKET NO.	CONFIRMATION NO.
10/604,271	07/08/2003	Yung-Feng Cheng	10109-US-PA	1270

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JIANQ CHYUN INTELLECTUAL PROPERTY OFFICE
7 FLOOR-1, NO. 100
ROOSEVELT ROAD, SECTION 2
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TAIWAN

EXAMINER

RUGGLES, JOHN S

ART UNIT

PAPER NUMBER

1756

DATE MAILED: 04/19/2005

Please find below and/or attached an Office communication concerning this application or proceeding.

Office Action Summary

Application No.

10/604,271

Applicant(s)

CHENG ET AL.

Examiner

John Ruggles

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-- The MAILING DATE of this communication appears on the cover sheet with the correspondence address --

Period for Reply

A SHORTENED STATUTORY PERIOD FOR REPLY IS SET TO EXPIRE 3 MONTH(S) FROM THE MAILING DATE OF THIS COMMUNICATION.

- Extensions of time may be available under the provisions of 37 CFR 1.136(a). In no event, however, may a reply be timely filed after SIX (6) MONTHS from the mailing date of this communication.
- If the period for reply specified above is less than thirty (30) days, a reply within the statutory minimum of thirty (30) days will be considered timely.
- If NO period for reply is specified above, the maximum statutory period will apply and will expire SIX (6) MONTHS from the mailing date of this communication.
- Failure to reply within the set or extended period for reply will, by statute, cause the application to become ABANDONED (35 U.S.C. § 133). Any reply received by the Office later than three months after the mailing date of this communication, even if timely filed, may reduce any earned patent term adjustment. See 37 CFR 1.704(b).

Status

- 1) ☒ Responsive to communication(s) filed on 08 July 2003.
- 2a) ☐ This action is **FINAL**. 2b) ☒ This action is non-final.
- 3) ☐ Since this application is in condition for allowance except for formal matters, prosecution as to the merits is closed in accordance with the practice under *Ex parte Quayle*, 1935 C.D. 11, 453 O.G. 213.

Disposition of Claims

- 4) ☒ Claim(s) 1-10 is/are pending in the application.
- 4a) Of the above claim(s) _____ is/are withdrawn from consideration.
- 5) ☐ Claim(s) _____ is/are allowed.
- 6) ☒ Claim(s) 1-10 is/are rejected.
- 7) ☒ Claim(s) 2-6 and 10 is/are objected to.
- 8) ☐ Claim(s) _____ are subject to restriction and/or election requirement.

Application Papers

- 9) ☒ The specification is objected to by the Examiner.
- 10) ☒ The drawing(s) filed on 08 July 2003 is/are: a) ☒ accepted or b) ☐ objected to by the Examiner.
Applicant may not request that any objection to the drawing(s) be held in abeyance. See 37 CFR 1.85(a).
Replacement drawing sheet(s) including the correction is required if the drawing(s) is objected to. See 37 CFR 1.121(d).
- 11) ☐ The oath or declaration is objected to by the Examiner. Note the attached Office Action or form PTO-152.

Priority under 35 U.S.C. § 119

- 12) ☐ Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f).
- a) ☐ All b) ☐ Some * c) ☐ None of:
1. ☐ Certified copies of the priority documents have been received.
2. ☐ Certified copies of the priority documents have been received in Application No. _____.
3. ☐ Copies of the certified copies of the priority documents have been received in this National Stage application from the International Bureau (PCT Rule 17.2(a)).
- * See the attached detailed Office action for a list of the certified copies not received.

Attachment(s)

- 1) ☒ Notice of References Cited (PTO-892)
- 2) ☐ Notice of Draftsperson's Patent Drawing Review (PTO-948)
- 3) ☐ Information Disclosure Statement(s) (PTO-1449 or PTO/SB/08)
Paper No(s)/Mail Date _____.
- 4) ☐ Interview Summary (PTO-413)
Paper No(s)/Mail Date. _____.
- 5) ☐ Notice of Informal Patent Application (PTO-152)
- 6) ☐ Other: _____.

DETAILED ACTION

Specification

The title of the invention is not fully descriptive. A new title is required that is clearly indicative of the invention to which the claims are directed.

The following title is suggested: PHOTOMASK WITH AN INTERNAL ASSISTANT PATTERN FOR ENHANCING RESOLUTION OF A MULTI-DIMENSIONAL PATTERN AND A LIGHT PROJECTION SYSTEM.

35 U.S.C. 112, first paragraph, requires the specification to be written in "full, clear, concise, and exact terms." The specification is replete with terms, which are not clear, concise and exact. The specification should be revised carefully in order to comply with 35 U.S.C. 112, first paragraph. Examples of some unclear, inexact or verbose terms used in the specification are: (1) in paragraph [0001], --Field-- has been misspelled; (2) in [0004] lines 2-4, the phrase "it is crucial that photolithographic processes having good resolution and a large depth of focus are required to form fine patterns" should be shortened and clarified (to e.g., --photolithographic processes having good resolution and a large depth of focus are required to form fine patterns--, etc.); and (3) in [0004] lines 6-7, "design of standard photomask having line patterns with very close spacing between the fine lines, places added" should be changed to --design of a standard photomask having line patterns with very close spacing between the fine lines, which places added--, in order to be grammatically correct. Note that due to the number of errors, those listed

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here are merely examples of the corrections needed and do not represent an exhaustive list thereof.

Appropriate correction is required. An amendment filed making all appropriate corrections must be accompanied by a statement that the amendment contains no new matter and also by a brief description specifically pointing out which portion of the original specification provides support for each of these corrections.

The abstract of the disclosure is objected to because: lines 7-14 do not properly describe the claimed invention as represented by Figures 3-4, specifically, (1) in lines 8-9, the “first pattern” and “second pattern” appear to be reversed since the lines in the vertical patterns 302 (**first** pattern) shown in Figure 3 are *perpendicular* to the common line of light exit apertures 34 while the internal assistant pattern 500 is shown to be in the lines of the horizontal patterns 352 (**second** pattern) and (2) in lines 10-14, “second pattern” should actually be --first pattern--, as shown in Figure 4 by the lines having the internal assistant pattern 500 in the vertical patterns 402 (**first** pattern) that are *parallel* to the common line of light exit apertures 44. Correction is required. See MPEP § 608.01(b).

Claim Objections

Claims 2-6 and 10 are objected to because of the following informalities: (1) at line 3 in each of claims 2, 6, and 10, “consisting, a square” should be changed to --consisting of a square--; (2) in both of claim 3 line 11 and claim 5 line 3, “lines...is” should be corrected to --

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lines...are-- and (3) in claim 3 line 14, --first-- has been misspelled between “said” and “or second”. Claims 4-6 depend on claim 3. Appropriate correction is required.

Claim Rejections - 35 USC § 112

The following is a quotation of the first paragraph of 35 U.S.C. 112:

The specification shall contain a written description of the invention, and of the manner and process of making and using it, in such full, clear, concise, and exact terms as to enable any person skilled in the art to which it pertains, or with which it is most nearly connected, to make and use the same and shall set forth the best mode contemplated by the inventor of carrying out his invention.

Claims 3-10 are rejected under 35 U.S.C. 112, first paragraph, as failing to comply with the enablement requirement. The claim(s) contains subject matter, which was not described in the specification in such a way as to enable one skilled in the art to which it pertains, or with which it is most nearly connected, to make and/or use the invention.

Claims 3 and 7 each recite “A **photomask** with an internal assistant pattern, **comprising: an opaque panel** comprising two light exit apertures, **for exposing the photomask**, wherein the two light exit apertures are positioned along a common line; ...” (emphasis added). However, paragraph [0019] lines 5-7 in reference to Figure 3 describe the opaque panel 30 ***of a light projection system*** comprising two light exit apertures 32 positioned along a common line 34. Similarly, paragraph [0022] lines 7-12 in reference to Figure 4 also describe the opaque panel 40 ***of a light projection system*** to have two light exit apertures 42 positioned along a common line 44. Thus, the above recitations of claims 3 and 7 are not enabled by the specification, which specifies that the opaque panel in each of Figures 3 and 4 is not part of the photomask at all, but rather is part of a light exposure system for exposing the photomask. For the purpose of this Office action and in order to expedite prosecution of this application, the above recitation in

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claims 3 and 7 has been interpreted to mean --A light projection system comprising: an opaque panel comprising two light exit apertures, for exposing a photomask, wherein the two light exit apertures are positioned along a common line; and the photomask comprising: ...-- (emphasis added). Claims 4-6 depend on claim 3 and claims 8-10 depend on claim 7. Accordingly, the recitation of "The photomask of claim..., wherein the internal assistant pattern is formed..." in each of claims 4-6 and 8-10 has also been interpreted to mean --The light projection system of claim..., wherein the internal assistant pattern of the photomask is formed...-- (emphasis added).

The following is a quotation of the second paragraph of 35 U.S.C. 112:

The specification shall conclude with one or more claims particularly pointing out and distinctly claiming the subject matter, which the applicant regards as his invention.

Claims 4-5 and 8-9 are rejected under 35 U.S.C. 112, second paragraph, as being indefinite for failing to particularly point out and distinctly claim the subject matter which applicant regards as the invention.

In claim 4, the recitation of "wherein the **internal assistant pattern** [of the photomask] is formed **in the first pattern** when the parallel **lines of the second pattern are positioned along a vertical direction with respect to the common line** of two light exit apertures" (emphasis added, in which the bracketed phrase has been interpreted as read into the claim for the reason explained above in this section by the rejection under the first paragraph of 35 USC 112) is inconsistent with the disclosed invention as exemplified by the description in [0019-0021] of instant Figure 3. For the purpose of this Office action and in order to expedite prosecution of this application, the above recitation in claim 4 has been interpreted to mean --

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wherein the **internal assistant pattern** [of the photomask] is formed in the **second** pattern when the parallel lines of the **first** pattern are positioned along a vertical direction **that is perpendicular** with respect to the common line of two light exit apertures--.

Similarly in claim 5, the recitation of “wherein the **internal assistant pattern** [of the photomask] is formed in the **second pattern** when the parallel lines of the **first pattern** is positioned along a vertical direction with respect to the common line of two light exit apertures” (emphasis added, in which the bracketed phrase has been interpreted as read into the claim for the reason explained above in this section by the rejection under the first paragraph of 35 USC 112) is inconsistent with the disclosed invention as exemplified by the description in [0022] of instant Figure 4. For the purpose of this Office action and in order to expedite prosecution of this application, the above recitation in claim 5 has been interpreted to mean -- wherein the **internal assistant pattern** [of the photomask] is formed in the **first** pattern when the parallel lines of the **first pattern** **are** positioned along a vertical direction **that is parallel** with respect to the common line of two light exit apertures--.

Also in claim 8 line 4, the phrase “a **vertical** direction with respect to the common line” (emphasis added) is inconsistent with the disclosed invention as exemplified by the description in [0019-0021] of instant Figure 3. For the purpose of this Office action and in order to expedite prosecution of this application, the above phrase in claim 8 has been interpreted to mean --a **vertical** direction **that is perpendicular** with respect to the common line”.

Similarly in claim 9 lines 4-5, the phrase “a **vertical** direction with respect to the common line” (emphasis added) is inconsistent with the disclosed invention as exemplified by the description in [0022] of instant Figure 4. For the purpose of this Office action and in order to

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expedite prosecution of this application, the above phrase in claim 9 has been interpreted to mean --a perpendicular direction with respect to the common line”.

Claim Rejections - 35 USC § 102

The following is a quotation of the appropriate paragraphs of 35 U.S.C. 102 that form the basis for the rejections under this section made in this Office action:

A person shall be entitled to a patent unless –

(e) the invention was described in (1) an application for patent, published under section 122(b), by another filed in the United States before the invention by the applicant for patent or (2) a patent granted on an application for patent by another filed in the United States before the invention by the applicant for patent, except that an international application filed under the treaty defined in section 351(a) shall have the effects for purposes of this subsection of an application filed in the United States only if the international application designated the United States and was published under Article 21(2) of such treaty in the English language.

Claims 1-2 are rejected under 35 U.S.C. 102(e) as being clearly anticipated by Pierrat (US Patent Application Publication 2002/0127479).

Pierrat teaches techniques for extending masks to form complex layout patterns (abstract) by including sub-resolution features or internal assistant patterns for optical proximity correction (OPC), as shown in Figure 21 (paragraphs [0179-0180]). In the mask of Figure 21, opaque field 250 surrounds closely spaced parallel lines of a first region 251 and a second region 252. Rectangular shaped sub-resolution or internal assistant patterns 253 and 254 are formed within region 251 and rectangular shaped sub-resolution or internal assistant patterns 255 and 256 are formed within region 252. These shaped sub-resolution internal assistant patterns (253-256) on the mask allow the closely spaced parallel lines imaged by mask regions 251 and 252 to be much straighter and much more uniform in the resulting exposure patterns ([0180] lines 7-9), as shown in Figure 22.

Claim Rejections - 35 USC § 103

The following is a quotation of 35 U.S.C. 103(a) which forms the basis for all obviousness rejections set forth in this Office action:

(a) A patent may not be obtained though the invention is not identically disclosed or described as set forth in section 102 of this title, if the differences between the subject matter sought to be patented and the prior art are such that the subject matter as a whole would have been obvious at the time the invention was made to a person having ordinary skill in the art to which said subject matter pertains. Patentability shall not be negated by the manner in which the invention was made.

Claims 3-10 are rejected under 35 U.S.C. 103(a) as being unpatentable over Pierrat (US Patent Application Publication 2002/0127479) in view of either Poschenrieder *et al.* (US Patent 5,815,247) or Tu *et al.* (US Patent 6,150,058).

As described above, Pierrat does not specifically teach: *[1]* a light projection system comprising an opaque panel having two light exit apertures positioned along a common line (for the beneficial use of dipole off-axis illumination during exposure of the mask) and *[2]* a mask having plural sets of parallel lines oriented in different (e.g., perpendicular, etc.) directions.

Poschenrieder *et al.* teach the beneficial use of an off-axis illumination or light projection system (Figure 1, e.g., for dipole off-axis illumination, etc.) involving the use of an aperture plate 12 that is alternatively shown in Figure 3A as an opaque panel having two openings or light exit apertures positioned along a common line *[1]* to illuminate a mask pattern 16 for the purpose of overcoming direction dependent differences in exposure behavior for various mask patterns (which is understood to include multi-directional mask patterns, abstract, column 3 lines 19-30, 47-49, and 51-53). The orientation of line patterns on the mask 16 and that of the common line between the two apertures of the dipole aperture plate 12 are directionally dependent. This is understood to mean that plural different directions or orientations of lines on the mask can be accommodated by an appropriate (e.g., 90°, etc.) twist or rotation of the dipole aperture plate

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between plural exposures at appropriate doses tailored to the desired proportions for providing the best overall image (column 3 lines 53-59). Figure 1 suggests that the common line of the dipole aperture plate 12 should be positioned perpendicular to the direction of parallel lines on the mask for each exposure to maximize the off-axis effect of dipole illumination [2].

Tu *et al.* also teach an optical or light projection system (Figure 5) for the beneficial use of dipole off-axis illumination by an alternative dipole aperture plate 22 having two light openings or apertures 28 equally spaced from the optical axis 26 of the dipole aperture plate such that the apertures 28 are co-linear (along a common line) with the optical axis 26, as shown in Figure 6B. This dipole off-axis illumination provides improved resolution and depth of field for mask patterns having a number of closely spaced parallel lines (column 4 line 53-63) and is also expected to reduce side lobe in a resulting image for closely spaced parallel lines running predominantly in one direction on a mask (column 2 lines 4-13, [1]). This dipole off-axis illumination suggests that the common line of the dipole aperture plate 22 would be positioned perpendicular to the direction of parallel lines on the mask for exposure to maximize the off-axis effect of dipole illumination. For parallel lines running in plural directions (e.g., that are perpendicular to each other, etc.) on the mask [2], quadrupole off-axis illumination can be used (column 2 lines 13-15).

It would have been obvious to one of ordinary skill in the art at the time of the invention to combine the use of internal assistant patterns in a first set of closely spaced parallel lines on the mask as taught by Pierrat with the use of a dipole off-axis illumination system taught by either Poschenrieder *et al.* or Tu *et al.* for a second set of closely spaced parallel lines without internal assistant patterns on the same mask, in which the second set of parallel lines has a

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different orientation or direction than that of the first set of parallel lines, [1], [2]. This is because it is beneficial to use dipole off-axis illumination in a light projection system for providing the best overall image when the common line of the dipole aperture plate is positioned perpendicular to the direction of a (second) set of parallel lines (not having internal assistant patterns) on the mask for each exposure to maximize the off-axis effect of dipole illumination, as taught by Poschenrieder *et al.* It is also expected to be beneficial to use dipole off-axis illumination in a light projection system for providing improved resolution and depth of field while reducing side lobe in a resulting image for mask patterns when the common line of the dipole aperture plate is positioned perpendicular to the direction of a (second) set of closely spaced parallel lines (without having internal assistant patterns) running predominantly in a single direction to maximize the off-axis effect of dipole illumination, as taught by Tu *et al.* All three cited references (Pierrat, Poschenrieder *et al.*, and Tu *et al.*) relate to the same art of optical proximity correction for closely spaced patterns, such as sets of parallel lines, on a mask used in photolithography (instant claims 3-10).

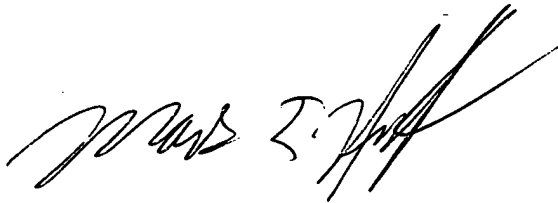
Conclusion

Any inquiry concerning this communication or earlier communications from the examiner should be directed to John Ruggles whose telephone number is 571-272-1390. The examiner can normally be reached on Monday-Thursday and alternate Fridays.

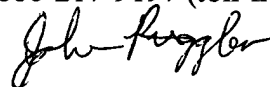
If attempts to reach the examiner by telephone are unsuccessful, the examiner's supervisor, Mark Huff can be reached on 571-272-1385. The fax phone number for the organization where this application or proceeding is assigned is 703-872-9306.

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Information regarding the status of an application may be obtained from the Patent Application Information Retrieval (PAIR) system. Status information for published applications may be obtained from either Private PAIR or Public PAIR. Status information for unpublished applications is available through Private PAIR only. For more information about the PAIR system, see <http://pair-direct.uspto.gov>. Should you have questions on access to the Private PAIR system, contact the Electronic Business Center (EBC) at 866-217-9197 (toll-free).



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Art Unit 1756